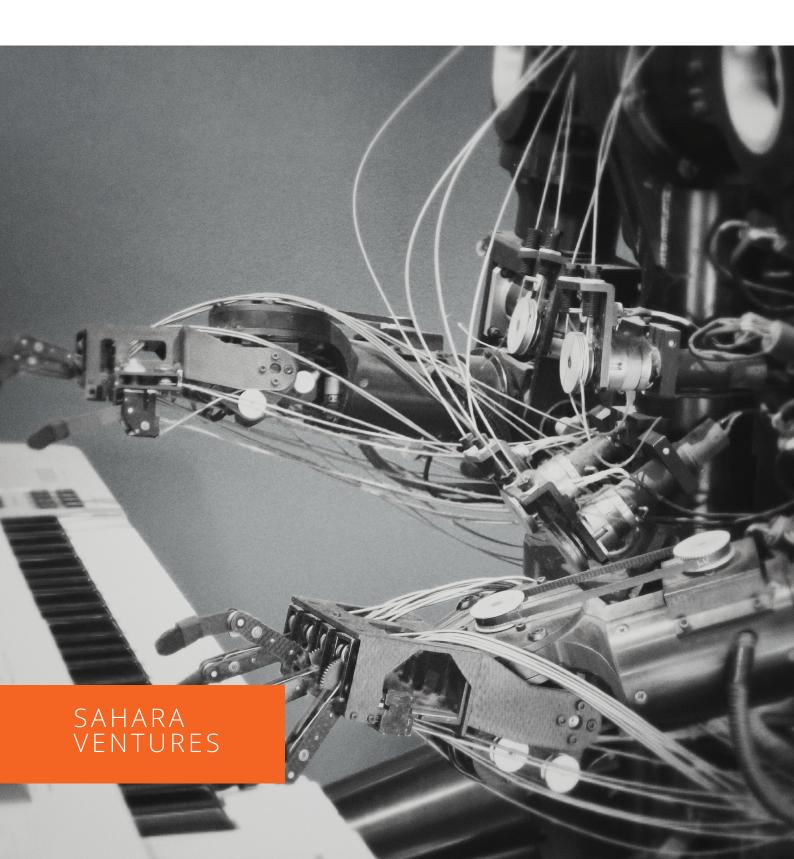
ARTIFICIAL INTELLIGENCE IN TANZANIA, WHAT'S HAPPENING.

LATEST INFORMATION ON ARTIFICIAL INTELLIGENCE STARTUPS AND PROJECTS IN TANZANIA

REPORT BY SAHARA VENTURES



VISIT...





ABOUT THE REPORT.

This report provides summary information of some of those solutions, how are they being used and who are the brains behind the solutions. The report is structured in four parts; the first part is about the existing startups,

This summary report is trying to highlight the existing projects and startups focusing on Artificial Intelligence. Recently, startups from Tanzania are adopting AI in different strategic sectors to find solutions for the most complex and pressing issues.

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans.

Startups such as Agrobot using a chatbot to provide relevant information to farmers, Dr. Elsa an Al-powered medical assistant and e-Shangazi a chatbot that provides curated and youths friendly sexual reproductive health information shows the future of adoption of the technology in Tanzania looks promising being led by local innovators and experts.

the second part is about projects carried by youths in the AI sector, the third part is the response of the survey that was carried at the University of Dodoma, College of Informatics and Virtual Education (CIVE) on how experts, lecturers, and students perceive the future of AI and how it will affect their lives and the last part is on obstacles that will affect the adaption of the technology.



DR. ELSA

Led by Ally Salim, Dr. Elsa is working on Alpowered Health and Telemedicine project which is looking to disrupt the health sector in Tanzania. Currently, Dr. Elsa is an Al-powered health assistant for healthcare providers. The startup is looking to solve the problem of a physician to patient ratio which currents stand at 1:20,000 in Tanzania. In Tanzania, 75 percent of physicians live in urban areas, poor resources for rural providers and the inadequate number of specialists is among the problem the innovation is addressing. Also, there is a lot of cases of overworked doctors and high patient loads.

Dr. Elsa is the winner of the #BotnarChallenge, the challenge was looking at how can we improve the health and wellbeing of young people in Tanzania using Al and digital solutions. The startup was also selected as the winners of the IndabaXKenya, a locally-organized, one-day Indaba (conference) that helps spread knowledge and builds capacity in machine learning also known as Deep Learning Indaba. Dr. Elsa is working with Ifakara Health Institute and Bagamoyo District Hospital. They have written a proposal for a study on the effectiveness of Al tools in pediatric care. The startup is undergoing post acceleration support at Sahara Accelerator.



AGROBOT

Agrobot is a platform that uses Artificial Intelligence (AI) to help farmers get proper information and advice regarding fertilizers, tools, medicine, and diseases through a chatbot or a normal SMS message.

The founder *Bless Mgongolwa* and his team are looking to solve the problem of access to accurate and timely information on diseases, fertilizers, tools, etc highly needed by the small-scale farmers to increase productivity and efficiency in the farming process.

Agrobot is among the four agritech startups that have received a proof of concept fund from the e-Kilimo Accelerator, agritech accelerator targeting innovative technological solutions for the agriculture sector in Tanzania. Agrobot was piloted with farmers in 3 cities in Tanzania; Iringa, Morogoro and Dar es Salaam.

The product is up and running. The team is looking for content partners and further improve the chatbot to include more information.



E-SHANGAZI

Led by *Dorah Peter*, e-Shangazi is a knowledge-sharing Al-powered platform that educates, informs and advice youths on Sexual Reproductive Health Rights (SRHr). The startup is among the startups that received seed fund from UNFPA to pilot the concept.

e-Shangazi is available in three platforms; Facebook, WhatsApp, and Slack. The team is using curated contents in accordance with the laws, policies, guidelines and delivery standards set for Health Service Provision, standards set by the Government of The United Republic of Tanzania. e-Shangazi came as a solution to solve the problem of access to quality, age appropriate and timely SRHr information to young people. The contents of the chatbot are in Swahili which makes it easier for non-English speakers to access and consume the contents.

The idea of e-Shangazi is also to ensure youth have privacy and confidentiality when engaging with the bot to access information. The startup as partnered with reputed partners such as Code For Africa and they are current diversifying the bot to include other health contents.



PARROT AL

Led by Davis David, Parrot AI is looking to transform how AI is being adopted by businesses in Tanzania. Parrot AI as a startup they are exploring a business model of offering AI technology as a service to local businesses.

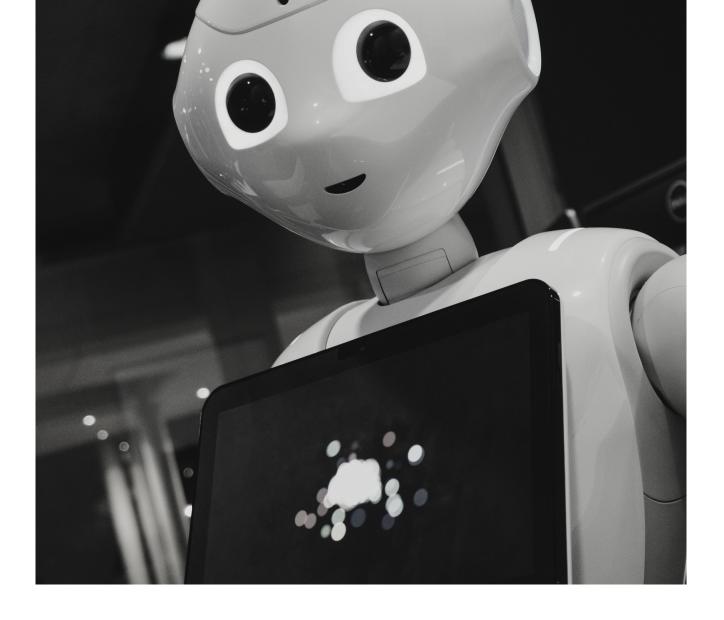
The key strength of Parrot AI is the diverse team of data scientists, researchers, ML and deep learning experts and their connection to the College of Informatics and Virtual Education at The University of Dodoma. The startup was found by students and graduates from the university.

Some of the projects Parrot AI has been involved in includes; Applying Machine intelligence for Agricultural Disease, Detection, Identification and Mapping, Smart-Urban: Strengthening Urban Management Capacity in Developing Worlds with Artificial Intelligence, and Leveraging Machine Learning in Diagnosing Urinary Tract Infections.

Parrot AI is championing the growth of the AI sector in Tanzania through training and outreach programs for university students. They are behind the AI4Youth initiative.

8 ARTIFICIAL
INTELLIGENCE
PROJECTS CARRIED
BY UNIVERSITY
STUDENTS AND
FACULTIES IN
TANZANIA.

ZOOMING IN UNIVERSITY OF DODOMA



INDABAX UNIVERSITY OF DODOMA

The University of Dodoma, College of Informatics and Virtual Education (CIVE) in collaboration with other partners; Parrot AI, Pythontz and CIVE AI community, organized a series of activities, workshops, meet-ups and keynotes on AI. The event supported by Indaba Africa, Sahara Ventures was among the sponsors.

Parrot AI in partnership with CIVE-AI community and CIVE AI Lab organized a technical AI workshop exposing the beneficiaries of the workshop on; Data Science with Python, Machine Learning and Deep Learning fundamentals, probabilistic machine learning and creating machine learning projects.

Different presenters had an opportunity to present and showcase what they are working on in relation to machine learning and deep learning. Ally Salim from Dr. Elsa was among those who presented their projects . Part of the four days program of IndabaX Tanzania students got the chance to showcase their Al projects to the attendees of the conference.

Sahara Ventures documented these projects to present them as part of this report to showcase the talent and potential of Tanzanian youths in the sector. Sahara Ventures mission is to build Africa's innovation and technology entrepreneurship ecosystem.

APPLYING TRANSFER LEARNING ON MOBINET FOR FACIAL AUTHENTICATION.

Looking to solve the problem of access to study loans for university students, *Ali Suleiman* and his team they are adopting Transfer Learning on MobiNet to recognize unique facial features. They are using MobiNet models optimized to run on low powered devices with limited resources, such as basic phones.

Ali and his team believes this technology will help on enhancing authentication of loans applicants hence reducing the chances of human errors and corrupt officials abusing the funds by allocating them to long people.

For face detection they are using OpenCV DNN for automatic face detection and annotation. They are still training and improving the model for higher efficiency, performance and accuracy.



AUGMENTED INTELLIGENCE (AI), ALSO REFERRED TO AS INTELLIGENCE
AUGMENTATION (IA) AND COGNITIVE AUGMENTATION, IS A COMPLEMENT—NOT A
REPLACEMENT—TO HUMAN INTELLIGENCE. IT'S ABOUT HELPING HUMANS BECOME
FASTER AND SMARTER AT THE TASKS THEY'RE PERFORMING.

EARLY DETECTOR OF MAIZE DISEASES.

Peresi Mgorozi and his team are working to address challenges facing farmers on detecting early stage infections of maize plants. Tanzania being among the major maize producers in Sub Saharan Africa someone has to find the solution.

They come up with the solution that can automatically detect disease at early stage, accurately and timely locate maize diseases throughout the cultivation field, using continuous image capturing techniques.

The team is using a data-set created from taking pictures of maize plant in a field. The image in the data-set is annotated by a domain expert. The data-set includes 4 category labels with 3 infected leafs and 1 are health leaf. They are using the resnet50 model (Resnet50), to extract the features from the earlier layer and train a classifier.

The project is still a work in progress, the team believes if the project succeed it will be used for the detection, diagnosis and recognition of maize plant leaf diseases.

DEVELOPMENT OF MACHINE LEARNING ALGORITHM FOR CLASSIFYING BANANA DISEASES FROM THE LEAF IMAGE.

Davis David and his team are trying to solve the problem of Banana Fungal diseases e.g Black Sigatoka and Fusarium Wilt. The team is trying to ease the process of detection of the diseases to help smallholders' farmers and extension officers to better manage and control the incidence of these diseases.

The team assessed the applicability of transfer learning from a deep Convolutional Neural Network (CNN) model for the banana image datasets. They used different resnet models to assess which one will provide best results. They conducted hyper-parameter search with aim to find best hyper-parameter that would give better results. The parameters included; are batch size, optimizer, momentum, learning rate, weight decay and model architecture.



IN DEEP LEARNING, A CONVOLUTIONAL NEURAL NETWORK (CNN, OR CONVNET) IS A CLASS OF DEEP NEURAL NETWORKS, MOST COMMONLY APPLIED TO ANALYZING VISUAL IMAGERY.

HEALTH CARE PREDICTION USING DATA MINING SYSTEMS.

Salim Amour Diwani and his team are working on the tool to help physicians (new or experienced) in medical diagnosis and prognosis at initial stages of the diseases.

The team mission is to save time, reduce healthcare costs, increase the quality healthcare delivery and reduce mortality and morbidity rate, which is very crucial in life threatening diseases. The tool is not expected to replace the physicians but rather increase their efficiency.

The team is using the raw data from Bombo Hospital CTC database. They created datasets from CTC HIV database with 9 attributes and 3527 instances (samples). The data-set includes 9 selected attributes, namely: Weight, Pregnancy Status, TB Screening ID, ARV Status Code, ARV Code, CD4, WHO Stage, Functional Status Code and ARV Adherence Code.

The data-set was selected for further examination and testing of the performance of different classifier algorithms to predict whether an individual being treated with HIV is classified to have a health status that is either good or poor.

APPLYING CONVOLUTIONAL NEURAL NETWORK FOR MALARIA DIAGNOSIS

Frederick Apina and his team are trying to increase efficiency in Malaria diagnosis by expert. They are trying to build up from existing technologies such as microscope that consumes time and labor from the technician. They are trying to reduce the burden of lab technicians in diagnosing Malaria.

The team obtained data-sets from the US National Library of Medicine. The data-sets contained 27,588 images belonging to two classes; parasites and uninfected classes. The team trained ResNet50 architecture model. After doing experiment their model was able to attain accuracy of 0.97. Accuracy alone doesn't tell the full story when you're working with a class-imbalanced data set but the team believes this is the right first step.



ACCURACY IS ONE METRIC FOR EVALUATING CLASSIFICATION MODELS.

INFORMALLY, ACCURACY IS THE FRACTION OF PREDICTIONS OUR MODEL GOT RIGHT.

APPLYING TRANSFER LEARNING ON RESIDUAL NETWORK FOR DIAGNOSING UTI.

Waziri Shebogholo and the Pilot AI team they are trying to find solution to address the problem of timely diagnosis of Urinary Tract Infection (UTI) especially in rural areas in developing countries.

The team is leveraging on the Convolutional Neural Networks (CNN) for visual recognition to diagnose UTI by processing microscopic urine sample images. They developed a method for classifying urine sample obtained from uninfected and UTI infected subject.

The team used ResNet Model (Resnet50) to extract the features from the earlier layers and train a classifier on top of that.

The project is still a work in progress. The team is looking to collect more data-sets to improve it's accuracy and reducing the margins of errors. They will apply image pre-processing techniques and try different tuning to observe how the model improves towards better results.

LEVERAGING MACHINE INTELLIGENCE FOR PNEUMONIA DIAGNOSIS

Ibrahim Mtandu and his team are trying to simplify the work that the doctor has to do to diagnose Pneumonia. Radiologist takes more than four hours to analyze single image of chest X-ray. The expert can decide to fasten the diagnosis process but this can increase the chances of human errors especially if the experts is new and inexperienced.

The team is using data created from chest X-ray image sample. The data-sets are annotated by the domain expert. The data-sets contains two models pneumonia and normal. They are adapting transfer learning with pre-trained models. These are the models which have been trained with large volume of data e.g Resnet and VGG. The project is still a work in progress but the team believes the solutions might save lives by helping in diagnosis of pneumonia.



OBJECT DETECTION IS THE PROCESS OF FINDING REAL-WORLD OBJECT INSTANCES LIKE CARS, BIKES,
TVS, FLOWERS, AND HUMANS IN STILL IMAGES OR VIDEOS. IT ALLOWS FOR THE RECOGNITION,
LOCALIZATION, AND DETECTION OF MULTIPLE OBJECTS WITHIN AN IMAGE, WHICH PROVIDES US WITH A
MUCH BETTER UNDERSTANDING OF AN IMAGE AS A WHOLE.

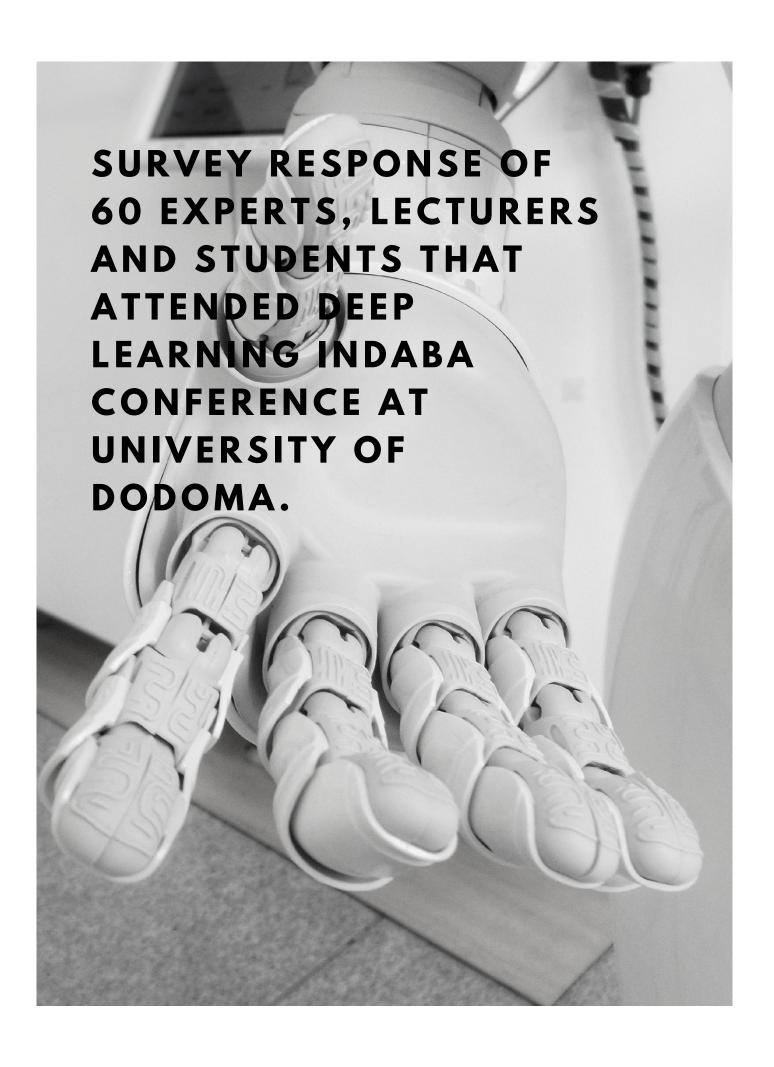
APPLYING OBJECT DETECTION TO DETECT AND COUNT CARS ON THE ROAD AND USE REINFORCEMENT LEARNING TO CONTROL CONGESTION.

ibrahim Mtandu and the Pilot Al team are involved in another project which is looking to address the problem of traffic congestion in African cities, case study Dar es Salaam.

The team believes the solution can help understanding the behavior of different roads hence helping urban planners and policy makers to make informed decisions on ways to tackle congestion in our roads.

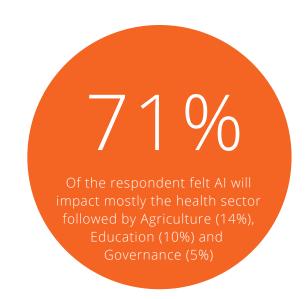
The team is adopting YOLO single convolution network that simultaneously predict multiple bounding boxes and class probabilities of the boxes. They trained a classifier on full images and directly optimizes detection performances.

The team believes their system will help addressing the problem more efficiently compared to the existing dumb system which doesn't address the problem of congestion in real time and is not smart enough to understand different behaviors of the road with respect to time, conditions, etc.



WHICH SECTOR WILL BE IMPACTED MOST BY AI IN AFRICA?

When 60 respondents were asked which sector they feel will be impacted most by Al in Africa.



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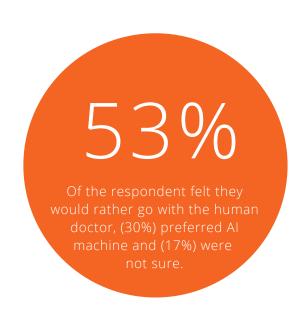
Of the respondents felt Al will come and take over their jobs, (29%) felt Al can't take over their jobs and (14%) were not sure

AI AND JOBS IN AFRICA.

When 60 respondents were asked do you think Al-supported machines will come and take over our jobs.

HUMAN DOCTOR VERSUS AI-POWERED MACHINE.

When 60 respondents were asked between a human doctor and an Al machine which one would you trust with your life?



POLITICAL LEADERS VERSUS AI MACHINE

When 60 respondents were asked between a politician and an Al machine which one would you trust to set your country strategy.

the respondent felt Al will do petter job setting up country's ategy, (23%) felt politicians will

of the respondent felt Al will do a better job setting up country's strategy, (23%) felt politicians will do a better job and (11%) were not sure.

76%

Of the respondents felt AI robots who have human like bodies will one day be working on streets with human beings and (14%) felt it is too

AI INTEGRATION WITH HUMAN BEINGS.

When 60 respondents were asked do you think we will one day be walking on streets alongside androids (Al robots who have human like bodies)?

AI GETTING SMARTER THAN HUMAN BEINGS

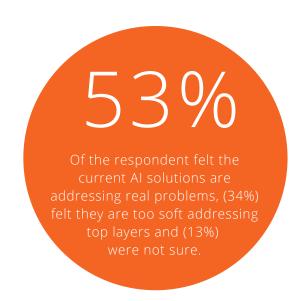
When 60 respondents were asked does Al becoming more intelligent than human beings concerns you.

55%

Of the respondent were not concerned while (45%) of the respondents were concerned by Al getting smarter than human beings.

THOUGHTS ON EXISTING AI SOLUTIONS IN AFRICA

When 60 respondents were asked What do you think about some of the current Al solutions in Africa.



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Of the respondents felt things will change for good, (1.5%) felt things will change for bad and (1.5%) were not sure.

AI AND THE FUTURE OF AFRICAN SOCIETIES.

When 60 respondents were asked what do you see as the future of African society after massive adaption of AI Technologies



ADAPTION AND SCALING OF THE AITECHNOLOGIES IN AFRICA.

When 60 respondents were asked what will be the biggest obstacles for the adaption and scaling of Al Technologies in Africa.

57%

Of the respondent felt lack of data is the biggest obstacle, (24%) policies and regulations, (11%) felt skills is the biggest challenge, (8%) and felt R&D will be the biggest obstacle.

59%

warfare is their biggest fear, (16%) were afraid the machines will take over the world, (14%) were afraid losing their jobs and the rest had other fears.

FEAR OF AI.

When 60 respondents were asked what is your biggest fear with Al?





OPPORTUNITIES

As the knowledge about Artificial Intelligence is becoming easily accessible through a platform such as Google AI, IBM DNA, Microsoft AI, etc. Youths (Students and Tech Enthusiasts) are taking the center stage to lead the adoption of the technology and to come up with innovative solutions.

African youths have a better chance to come up with the most relevant solutions adopting AI to address the most pressing issues in developing economies. Our corporate companies, universities, R&D institutions and public sector have a chance to capitalize on both the technology and the talents who can work with the technology to ensure the technology create the intended impacts.

CHALLENGES

Most of the people we talked to they believed what will be the biggest obstacle for the adaption and scaling of Al technology in Africa is the availability of relevant and accurate data to drive the technology.

Other respondents also felt it will take too long for Africa to set policies and regulations for ease adaptability of the technology especially on sensitive sectors such as health even though they were optimistic about the future. They also felt a lack of skills and investment in R&D will make the continent lag behind in the sector.

We would like to appreciate the support of all the contributors to the report. The students and faculties from University of Dodoma, College of Informatics and Virtual Education. The startups (Parrot Al, Agrobot, Dr. Elsa and e-Shangazi). The students who shared their projects during the Deep Learning Indaba Conference at University of Dodoma and the organizers of the IndabaX conference in Tanzania.

This is the first open report on the status of Artificial Intelligence in Tanzania focusing on startups and projects. We believe there will be more to come in the future.

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